Ernest Orlando Lawrence Berkeley National Laboratory

Earth Sciences Division Research Summaries 2002-2003

A Perspective from the Division Director

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Research in earth and atmospheric sciences is becoming increasingly important in light of the energy, climate change, and environmental issues facing the United States and the world. The development of new energy resources other than hydrocarbons and the safe disposal of nuclear waste and greenhouse gases (such as carbon dioxide and methane) are critical to the future energy needs and environmental safety of this planet. In addition, the cleanup of many contaminated sites in the U.S., along with the preservation and management of our water supply, remain key challenges for us as well as future generations.

Addressing these energy, climate change, and environmental issues requires the timely integration of earth sciences' disciplines (such as geology, hydrology, oceanography, climatology, geophysics, geochemistry, geomechanics, ecology, and environmental sciences). This integration will involve focusing on fundamental crosscutting concerns that are common to many of these issues. A primary focus will be the characterization, imaging, and manipulation of fluids in the earth. Such capabilities are critical to many DOE applications, from environmental restoration to energy extraction and optimization.

The Earth Sciences Division (ESD) of the Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) is currently addressing many of the key technical issues described above.

Our total staff of over 200 scientists, UC Berkeley faculty, support staff and guests—performing world-acclaimed fundamental research in hydrogeology and reservoir engineering, geophysics and geomechanics, geochemistry, microbial ecology, and environmental engineering—provide the foundation for all of our programs. Building on this scientific foundation, we perform applied earth science research and technology development to support the Department of Energy in a number of its program areas, namely:

- Fundamental and Exploratory Research--fundamental research to provide a basis for new and improved energy and environmental technologies
- Nuclear Waste Management—theoretical, experimental and simulation studies of the unsaturated zone at Yucca Mountain, Nevada
- Energy Resources—collaborative projects with industry to develop or improve technologies for the exploration and production of oil, gas, and geothermal reservoirs
- Environmental Remediation Technology—innovative technologies for locating, containing, and remediating metals, radionuclides, chlorinated solvents, and energy-related contaminants in soils and groundwaters
- Climate Change and Carbon Management—geologic sequestration of carbon dioxide, carbon cycling in the oceans and terrestrial biosphere, and regional climate modeling, which are the cornerstones of a major new divisional research thrust related to understanding and mitigating the effects of increased greenhouse gas concentrations in the atmosphere.

In this document, we present summaries of many of our current research projects. While it is not a complete accounting, it is representative of the nature and breadth of our research effort. We are proud of our scientific efforts, and we hope that you will find our research useful and exciting. Any comments on our research are appreciated and can be sent to me personally.

This report is divided into five sections that correspond to the major research programs in the Earth Sciences Division:

- Fundamental and Exploratory Research
- Nuclear Waste
- Energy Resources
- Environmental Remediation Technology
- Climate Variability and Carbon Management

These programs draw from each of ESD's disciplinary departments: Microbial Ecology and Environmental Engineering, Geophysics and Geomechanics, Geochemistry, and Hydrogeology and Reservoir Dynamics. Short descriptions of these departments are provided as introductory material. A list of publications for the period from January 2002 to June 2003, along with a listing of our personnel, are appended to the end of this report.

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